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FIG. 1a

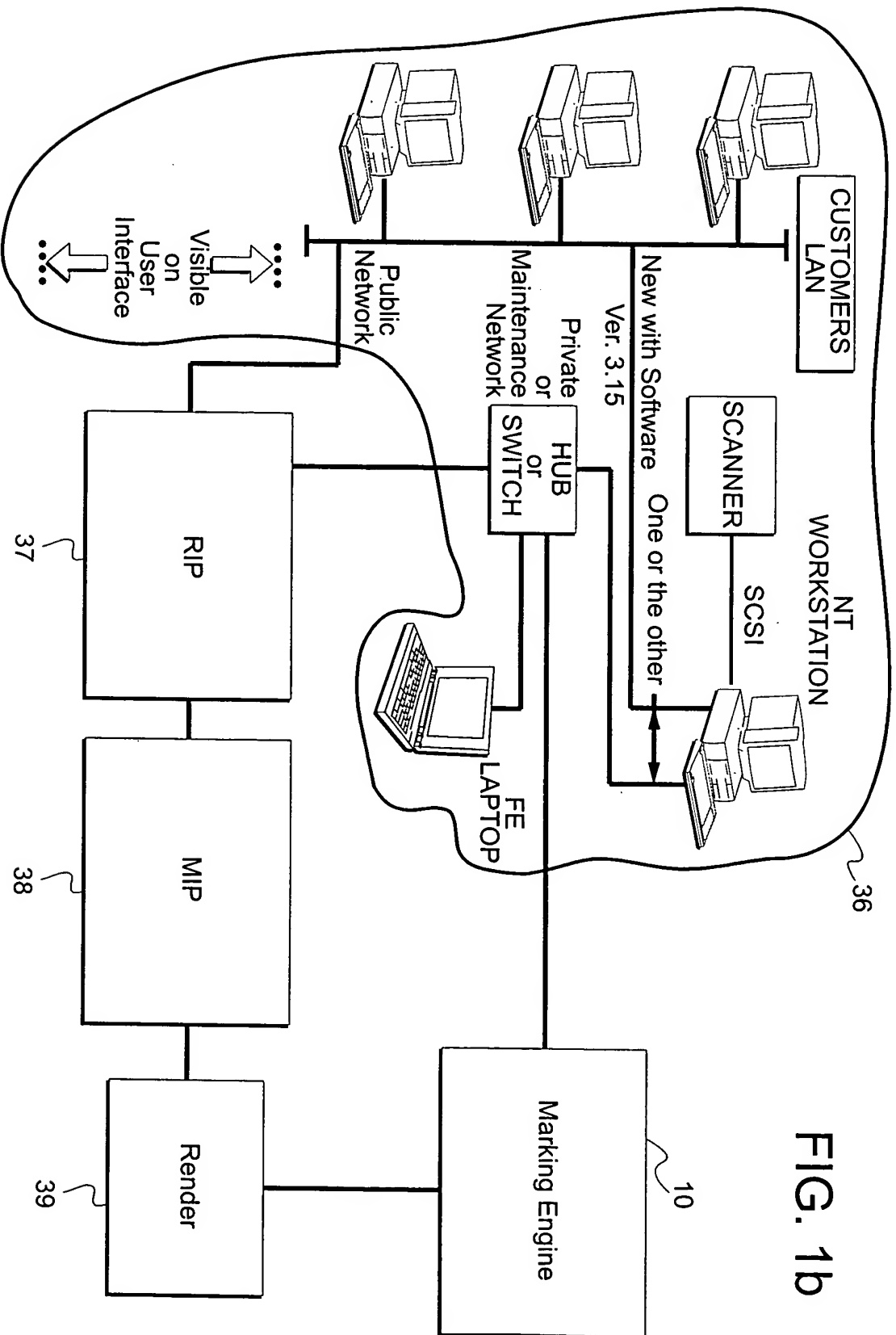


FIG. 1b

Algorithm Block Diagram

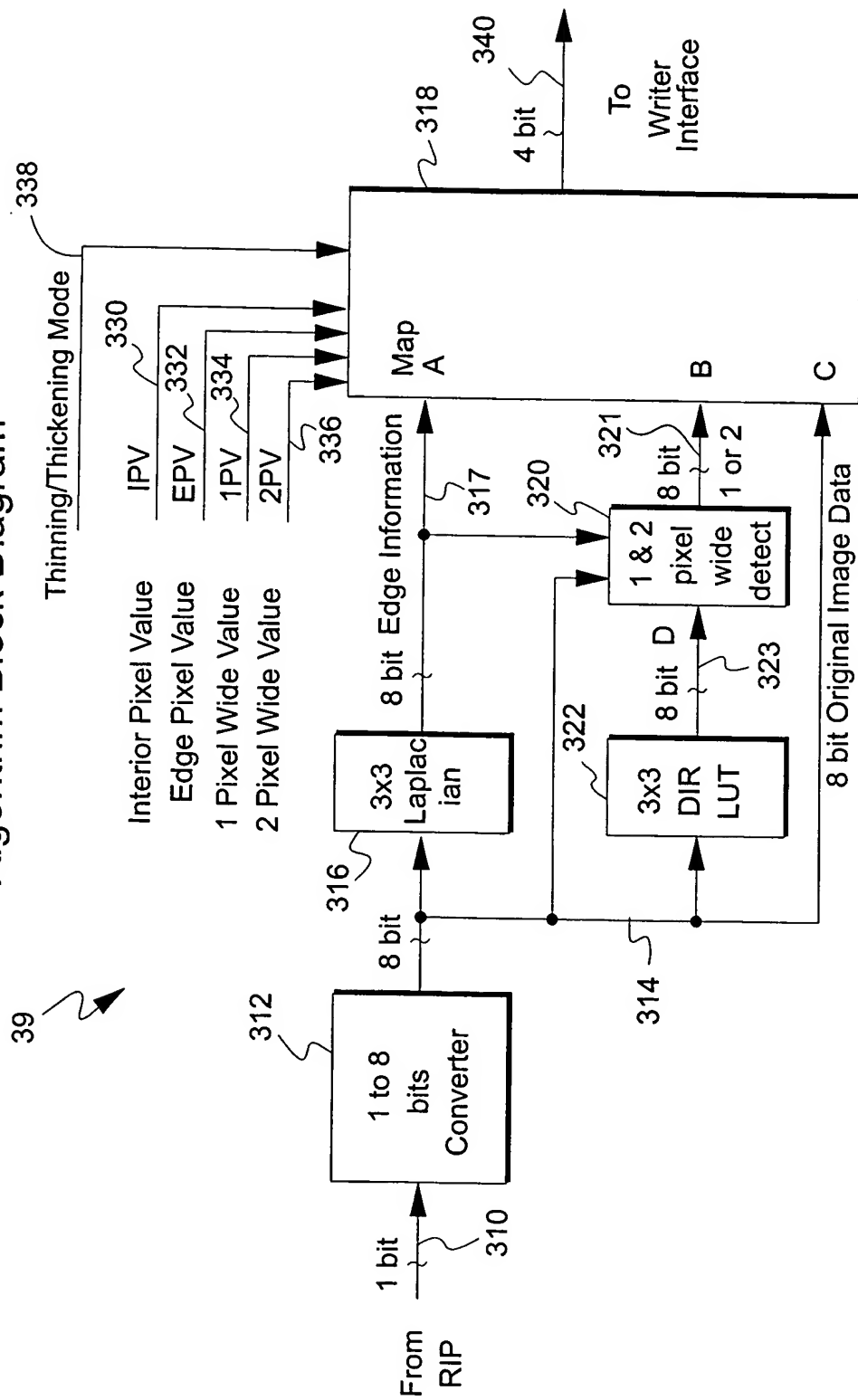


FIG. 2

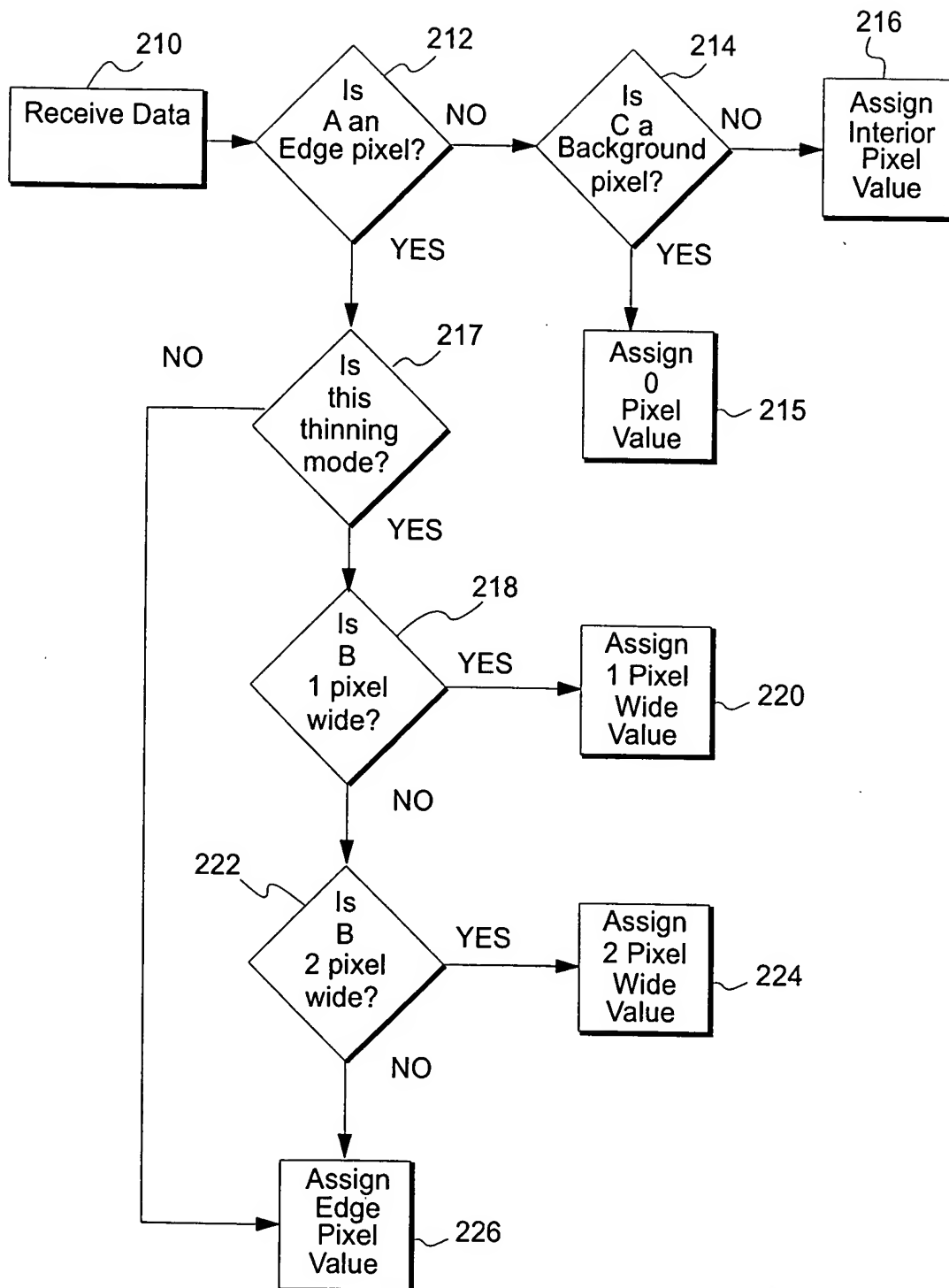


FIG. 3

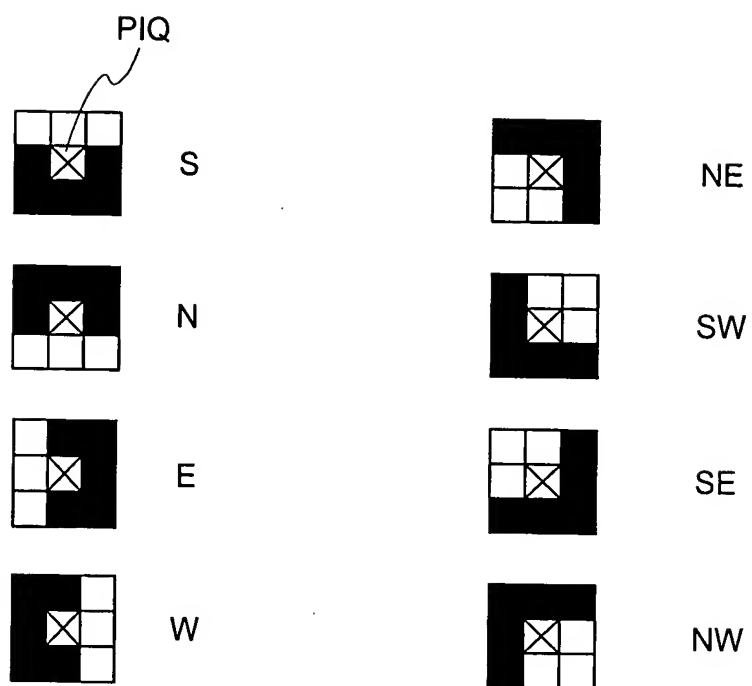


FIG. 4

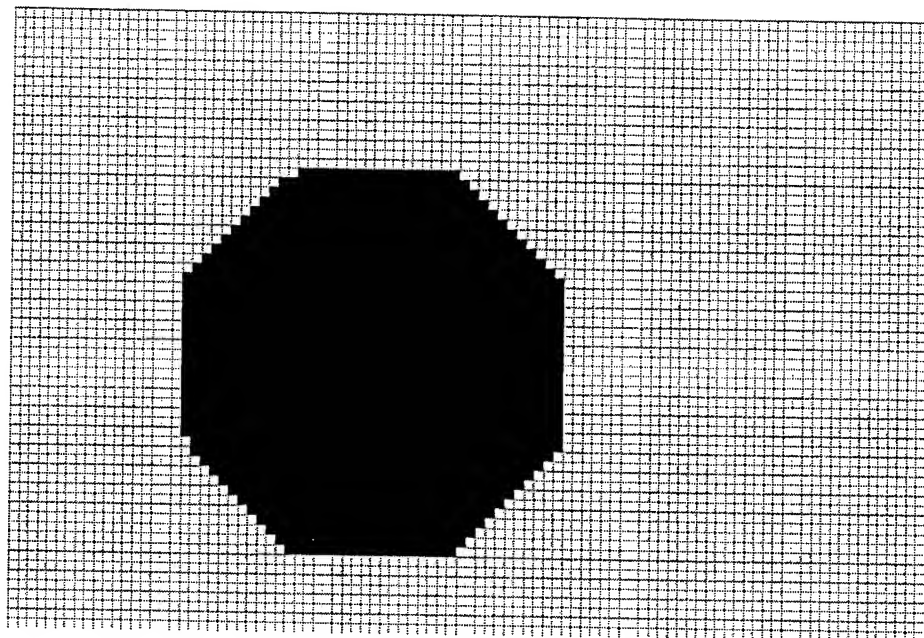


Fig. 5a
Original object bitmap

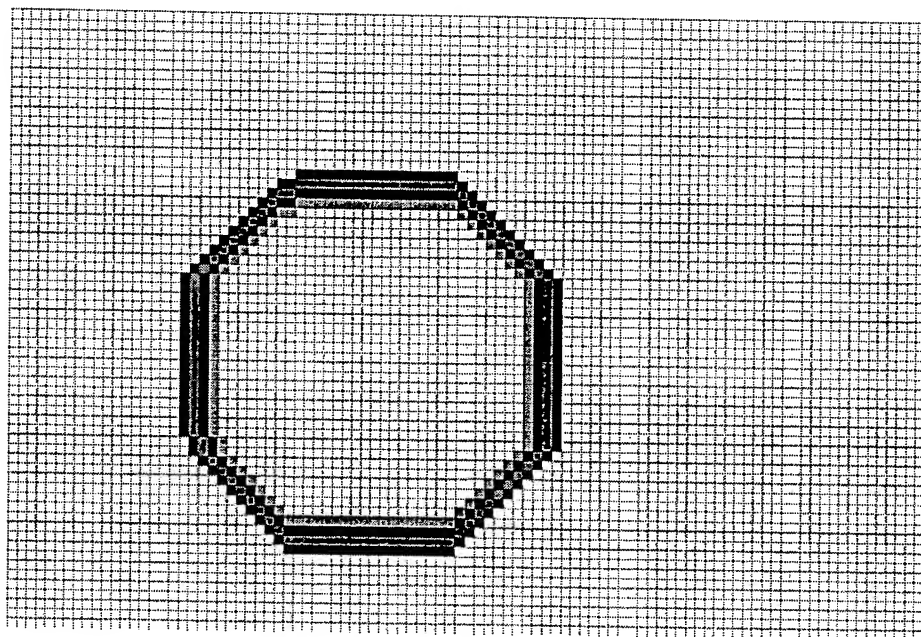


Fig. 5b
Four onion skin layers
when thinning

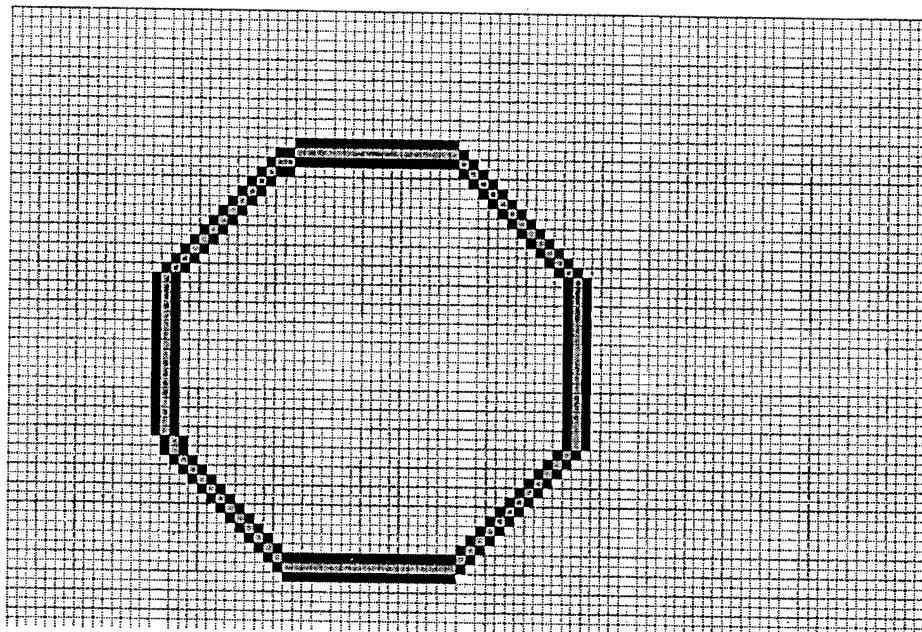


Figure 5c
Three onion skin layers
when thickening

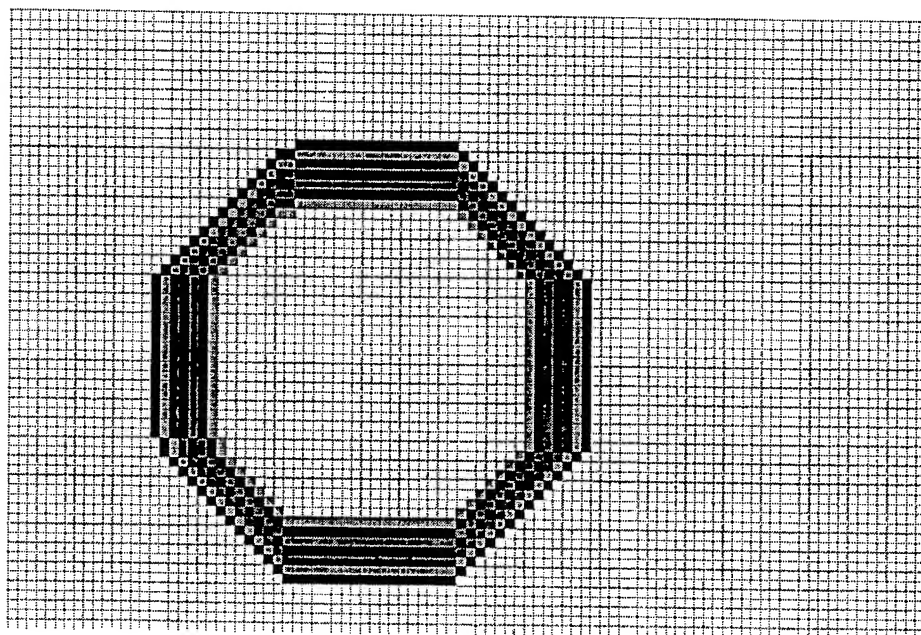


Fig. 5d
All layers
(thickening and thinning)

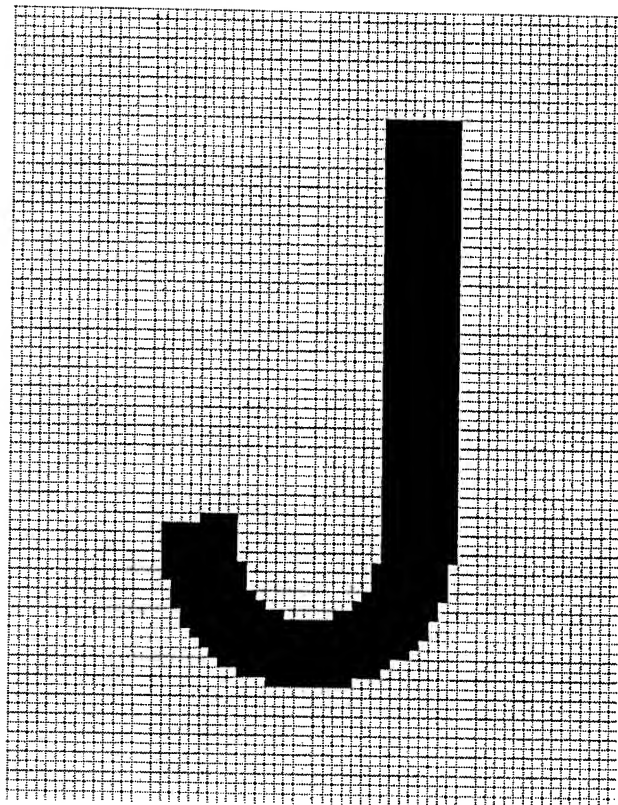


Fig. 6a
Original

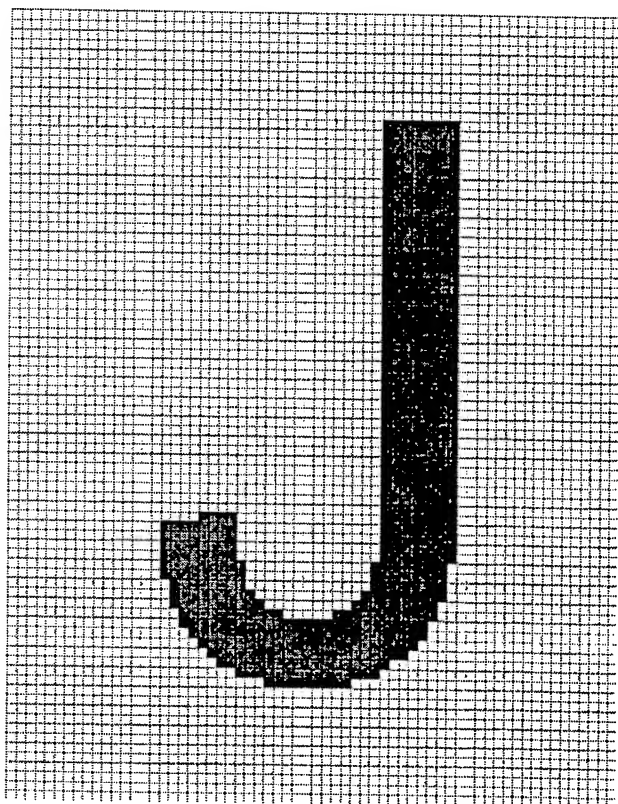


Fig. 6b
Same grey pixel value
assigned to edges and
solid area density

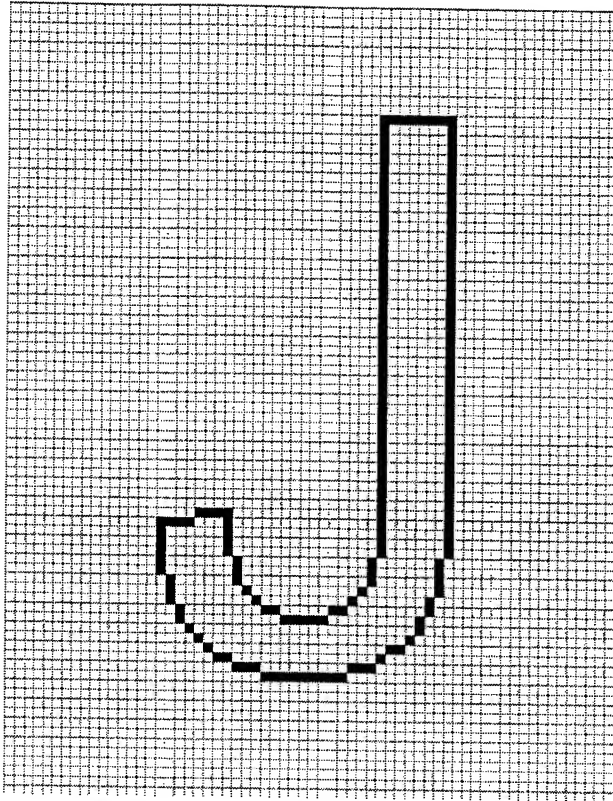


Fig. 6c
Edges when
thinning

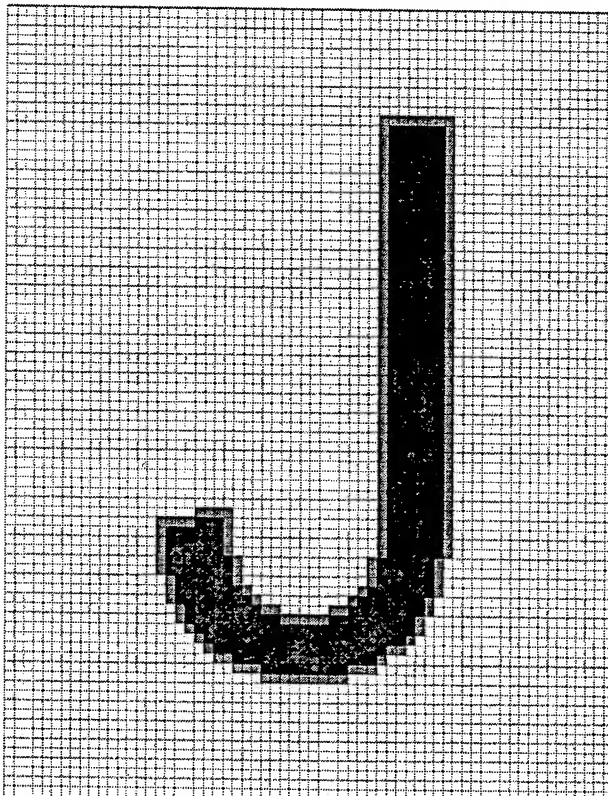


Fig. 6d
Lightened -
Solid area density reduced
Letter thinner

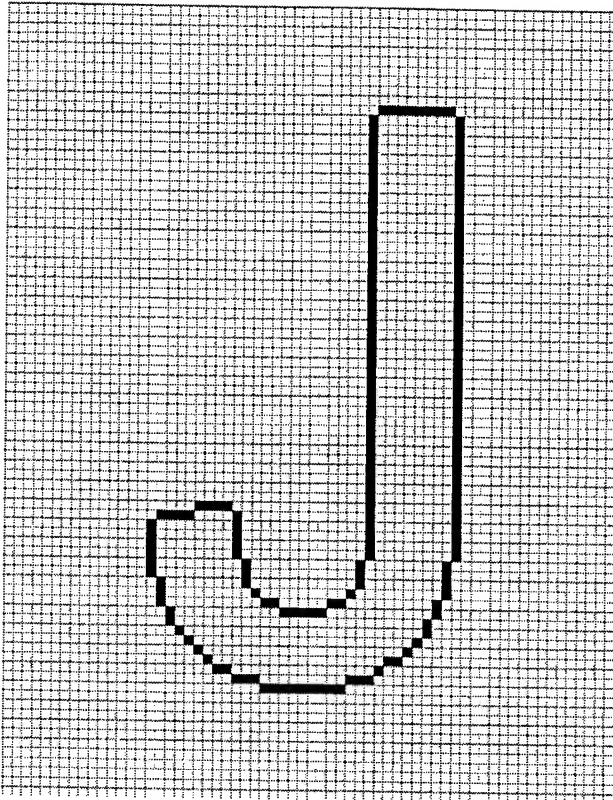


Fig. 6e
Edges when
thickening

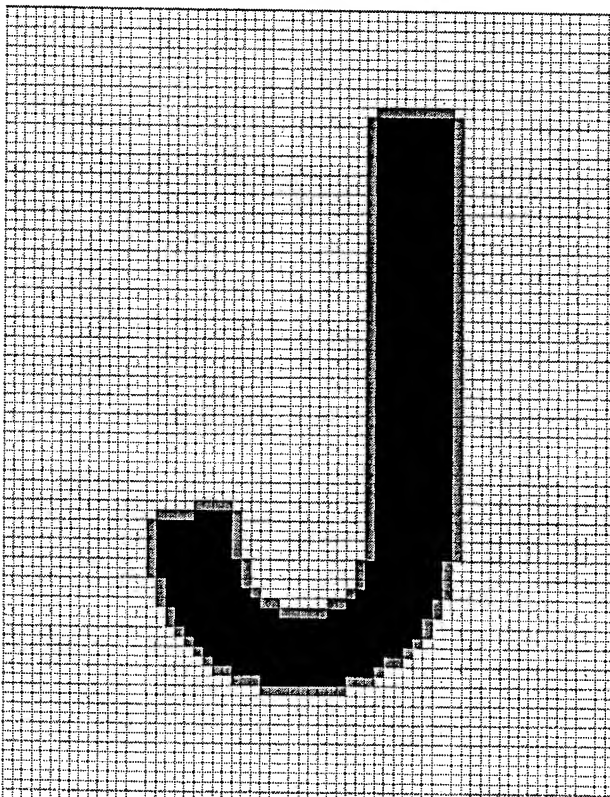
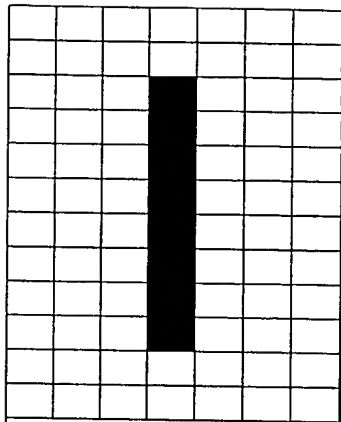


Fig. 6f
Thickened
Letter thickened by
applying grey edges which
were originally white

1 Pixel Wide Detection

Original 1 pixel wide line

FIG. 7a



Edge Pixels

FIG. 7b

| | | | | | | |
|---|---|---|-----|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Direction Values

FIG. 7c

| | | | | | | |
|---|---|----|---|----|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | SE | S | SW | 0 | 0 |
| 0 | 0 | E | S | W | 0 | 0 |
| 0 | 0 | E | 0 | W | 0 | 0 |
| 0 | 0 | E | 0 | W | 0 | 0 |
| 0 | 0 | E | 0 | W | 0 | 0 |
| 0 | 0 | E | 0 | W | 0 | 0 |
| 0 | 0 | E | 0 | W | 0 | 0 |
| 0 | 0 | E | 0 | W | 0 | 0 |
| 0 | 0 | E | 0 | W | 0 | 0 |
| 0 | 0 | E | N | W | 0 | 0 |
| 0 | 0 | NE | N | NW | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Assignment

BP: Background Pixel

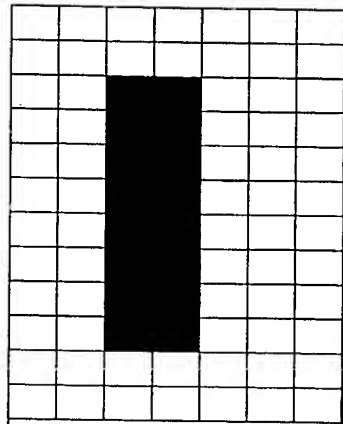
EP: Edge Pixel

1W: One Pixel Wide Line

FIG. 7d

| | | | | | | |
|----|----|----|----|----|----|----|
| BP | BP | BP | BP | BP | BP | BP |
| BP | BP | BP | BP | BP | BP | BP |
| BP | BP | BP | EP | BP | BP | BP |
| BP | BP | BP | 1W | BP | BP | BP |
| BP | BP | BP | 1W | BP | BP | BP |
| BP | BP | BP | 1W | BP | BP | BP |
| BP | BP | BP | 1W | BP | BP | BP |
| BP | BP | BP | 1W | BP | BP | BP |
| BP | BP | BP | EP | BP | BP | BP |
| BP | BP | BP | BP | BP | BP | BP |
| BP | BP | BP | BP | BP | BP | BP |

2 Pixel Wide Detection



Original 2 pixel wide line

FIG. 8a

| | | | | | | |
|---|---|-----|-----|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 255 | 255 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Edge Pixels

FIG. 8b

| | | | | | | |
|---|----|----|----|----|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | SE | S | S | SW | 0 | 0 |
| 0 | E | SE | SW | W | 0 | 0 |
| 0 | E | E | W | W | 0 | 0 |
| 0 | E | E | W | W | 0 | 0 |
| 0 | E | E | W | W | 0 | 0 |
| 0 | E | E | W | W | 0 | 0 |
| 0 | E | E | W | W | 0 | 0 |
| 0 | E | E | W | W | 0 | 0 |
| 0 | E | NE | NW | W | 0 | 0 |
| 0 | NE | N | N | NW | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Direction Values

FIG. 8c

| | | | | | | |
|----|----|----|----|----|----|----|
| BP | BP | BP | BP | BP | BP | BP |
| BP | BP | BP | BP | BP | BP | BP |
| BP | BP | EP | EP | BP | BP | BP |
| BP | BP | 2W | 2W | BP | BP | BP |
| BP | BP | 2W | 2W | BP | BP | BP |
| BP | BP | 2W | 2W | BP | BP | BP |
| BP | BP | 2W | 2W | BP | BP | BP |
| BP | BP | 2W | 2W | BP | BP | BP |
| BP | BP | 2W | 2W | BP | BP | BP |
| BP | BP | EP | EP | BP | BP | BP |
| BP | BP | BP | BP | BP | BP | BP |
| BP | BP | BP | BP | BP | BP | BP |

Assignment

BP: Background Pixel

EP: Edge Pixel

2W: Two Pixel Wide Line

FIG. 8d

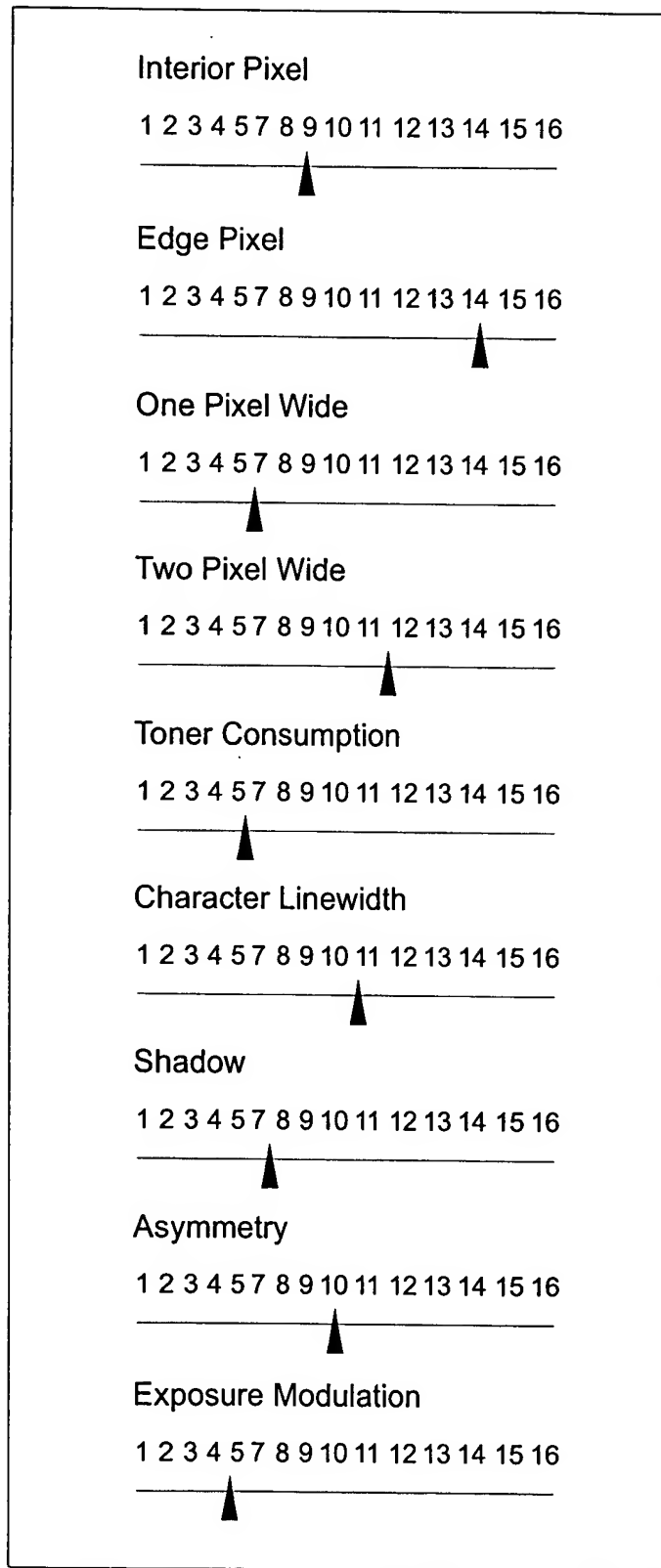


FIG. 9

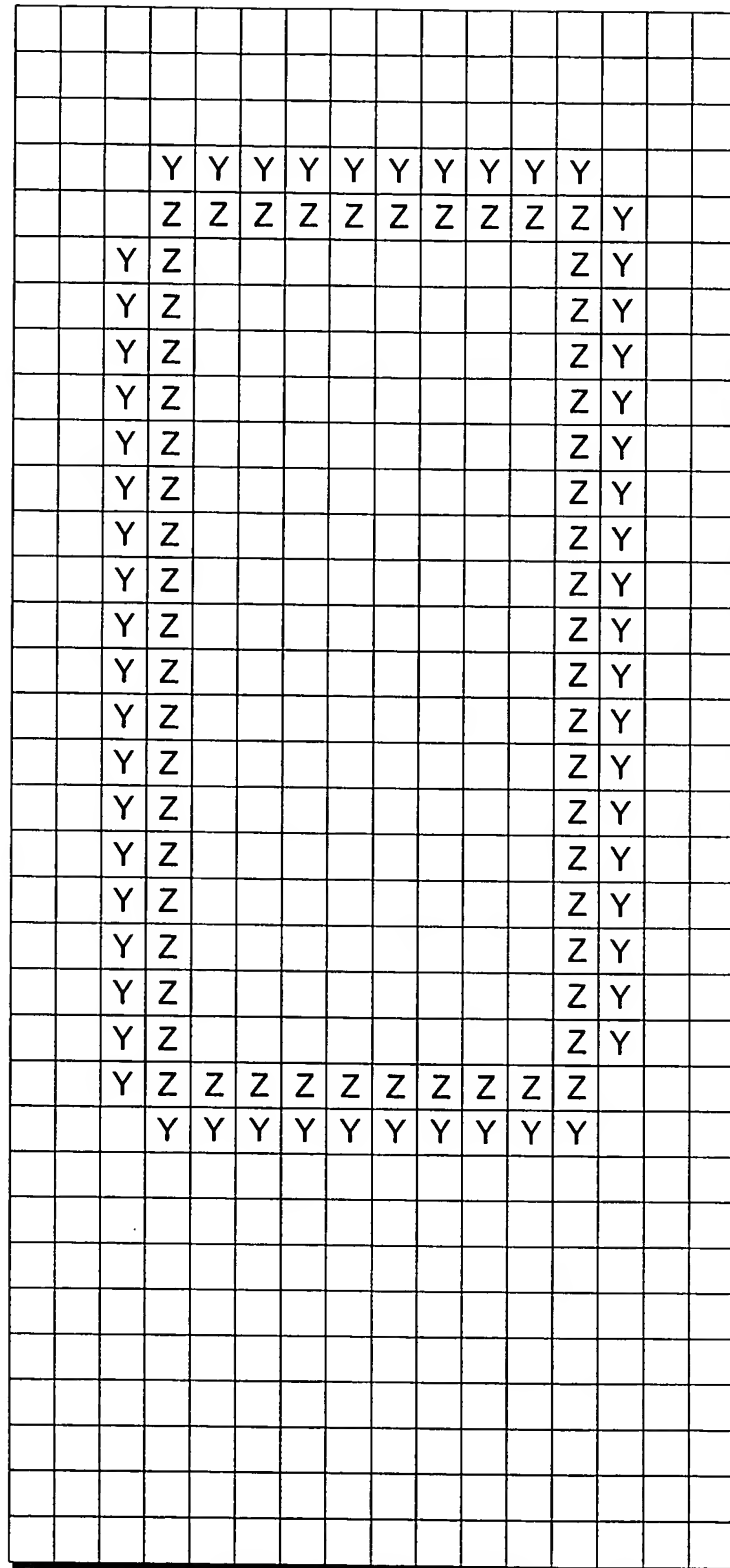


FIG. 10

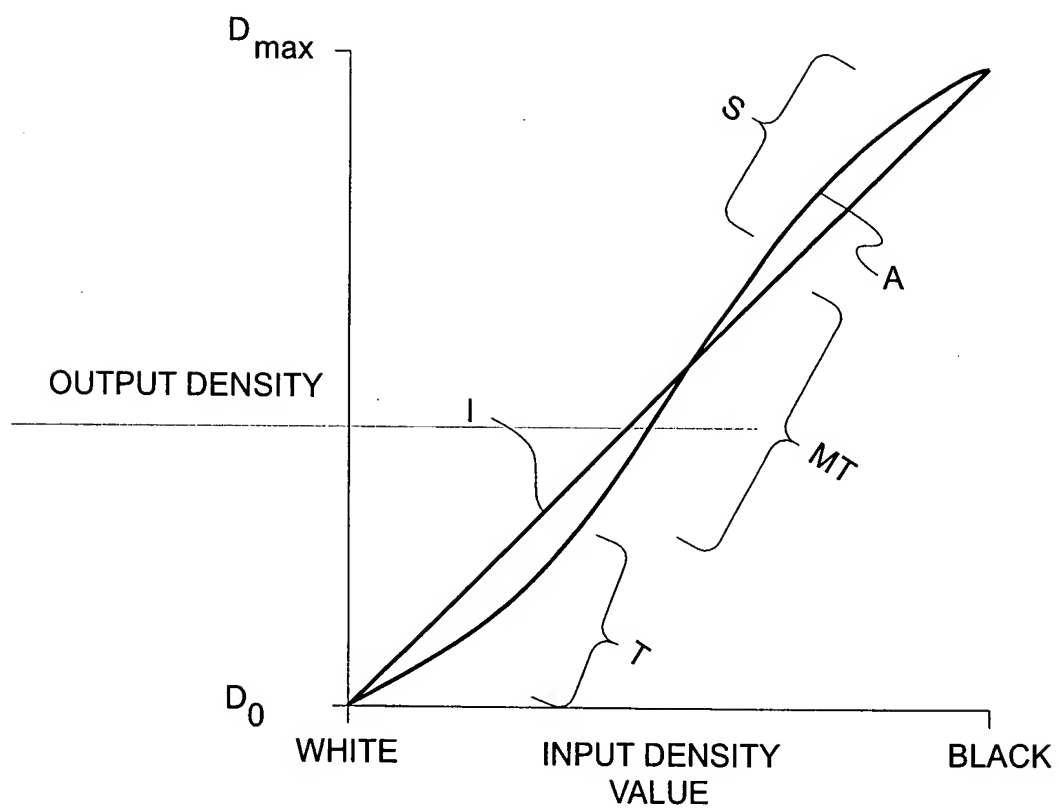


FIG. 11

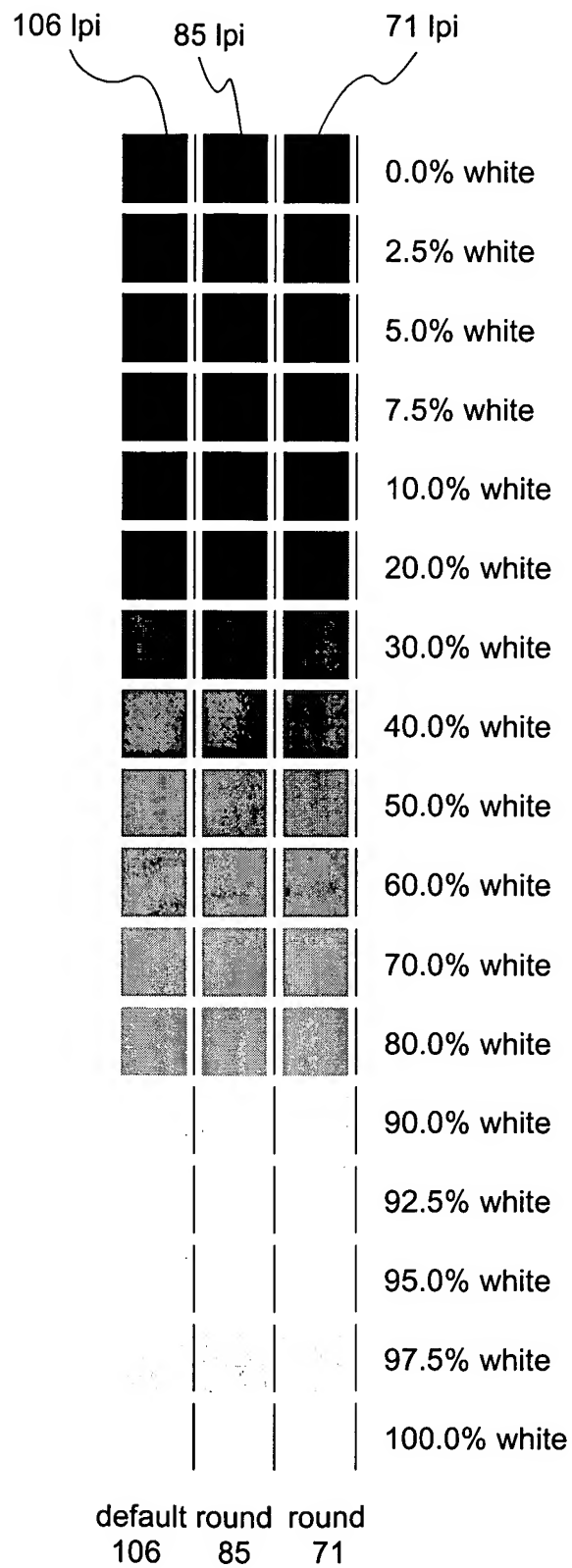


FIG. 12

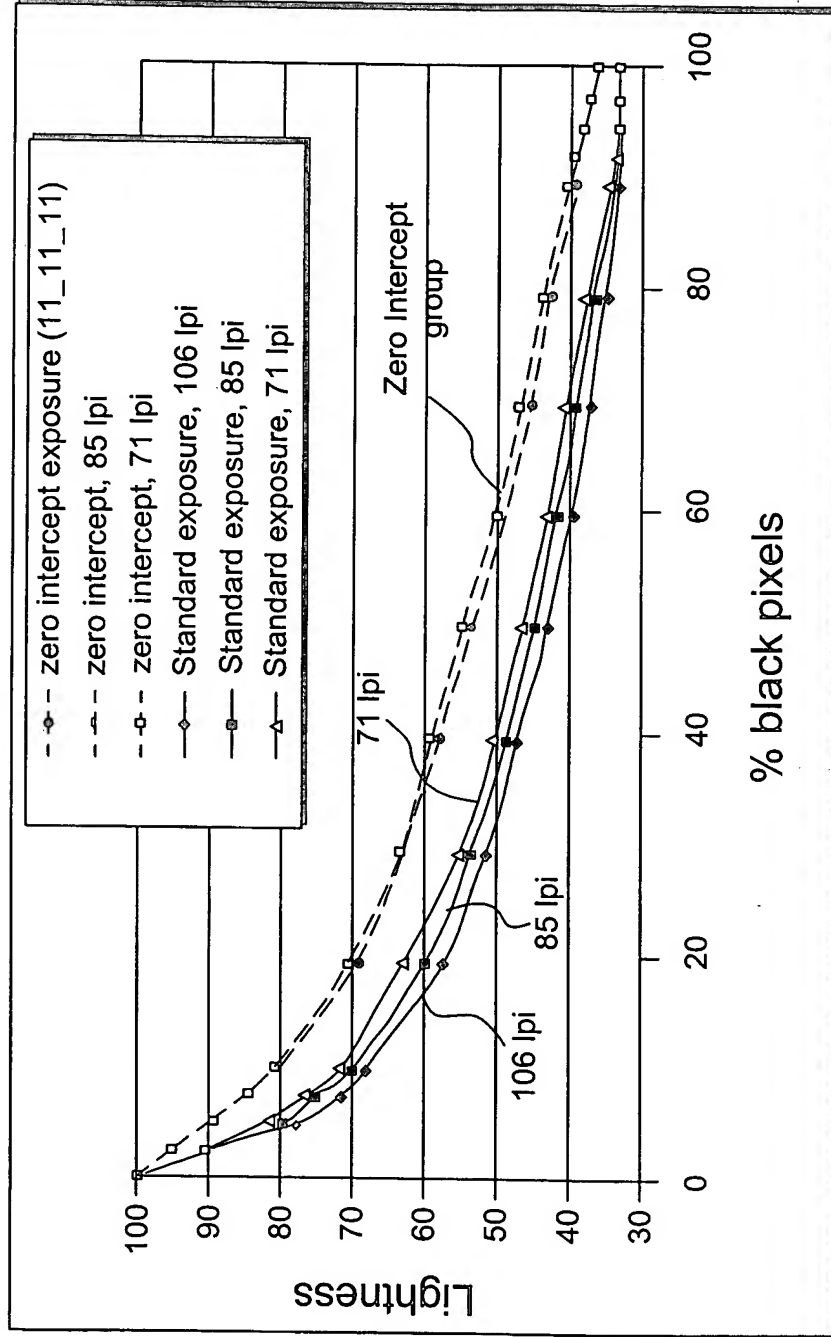


FIG. 13

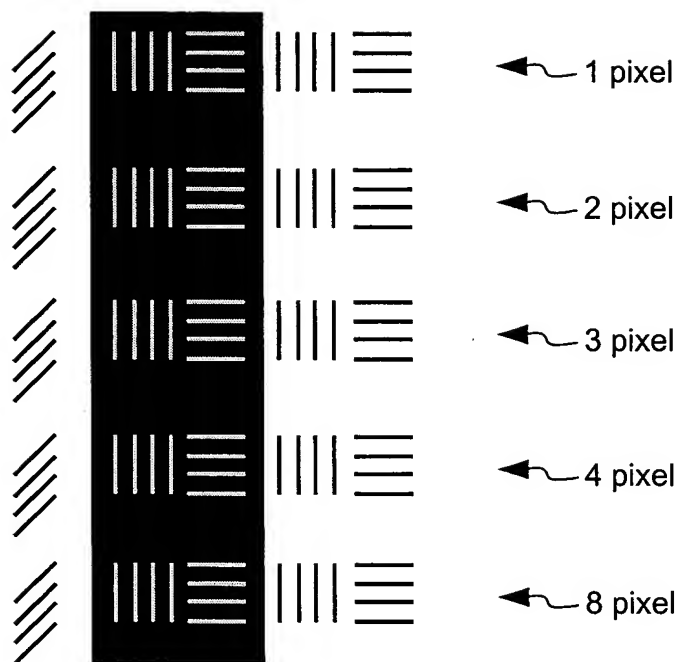


FIG. 14

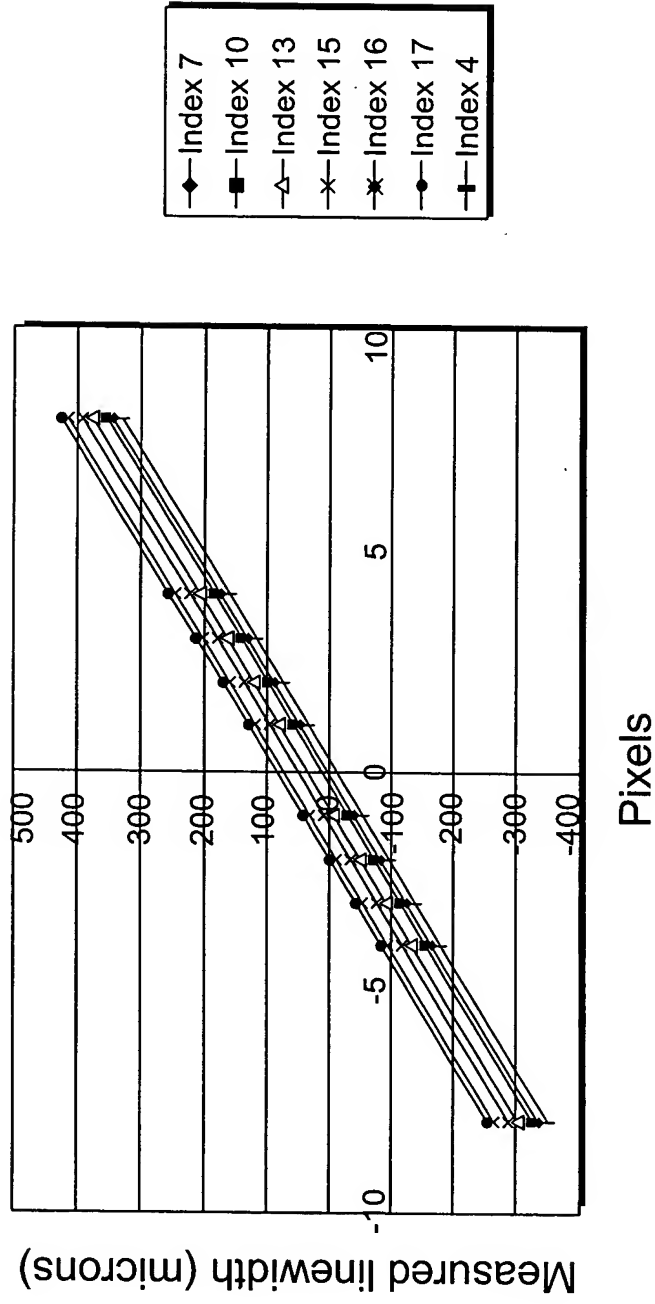


FIG. 16

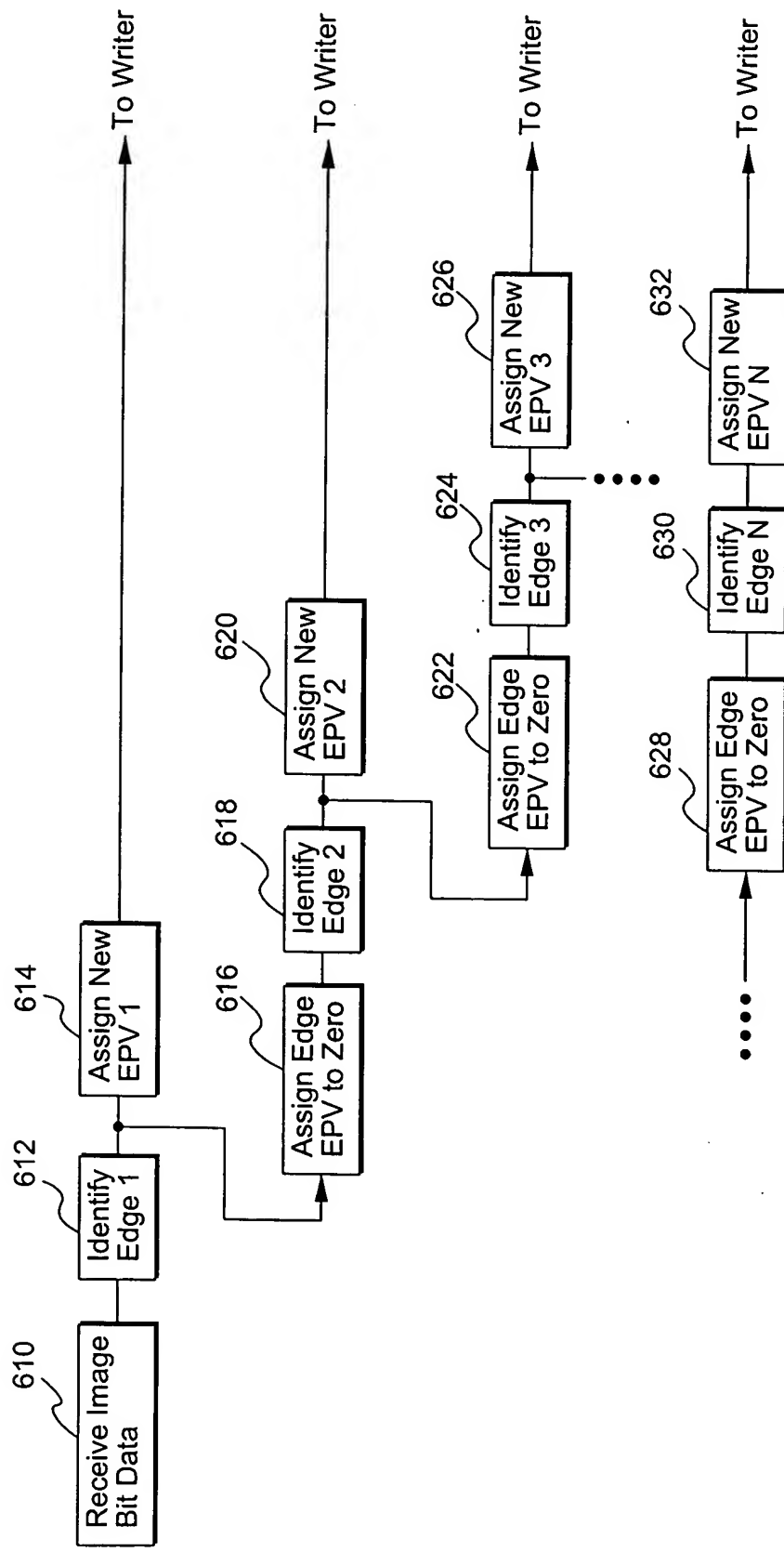


FIG. 17

FIG. 18a

| | | |
|----|-----|----|
| b7 | b6 | b5 |
| b4 | PIQ | b3 |
| b2 | b1 | b0 |

FIG. 18b

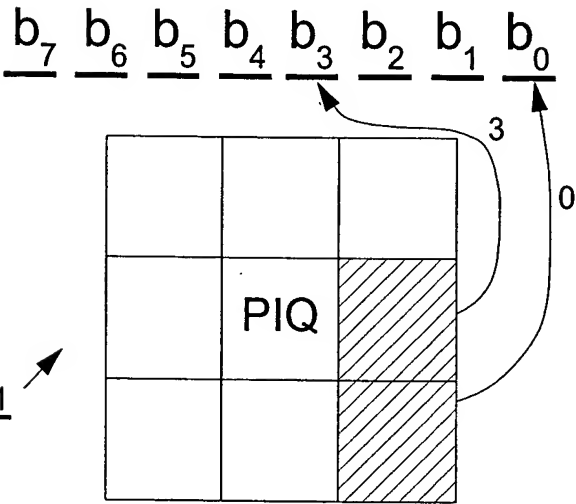
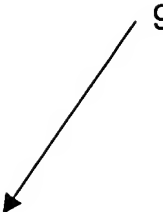


FIG. 18c

00001001 ↗

Fig. 18d

9



| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 0 | SE | S | S | SW | S | S | S | E | E | SE | SE | SE | SE | S | SE |
| W | SW | SW | S | W | SW | SW | SW | 0 | SE | S | S | SW | S | S | S |
| NE | E | SE | SE | 0 | SE | S | S | E | E | E | SE | E | E | SE | SE |
| NW | 0 | SW | S | W | SW | SW | S | NE | E | SE | SE | 0 | SE | S | S |
| N | NE | 0 | SE | NW | 0 | SW | S | NE | E | E | E | NE | E | SE | SE |
| NW | NW | W | SW | W | W | W | SW | N | NE | 0 | SE | NW | 0 | SW | S |
| N | NE | NE | E | N | NE | 0 | SE | NE | NE | E | E | NE | E | E | E |
| N | N | NW | 0 | NW | NW | W | SW | N | NE | NE | E | N | NE | 0 | SE |
| NW | 0 | SW | S | W | SW | SW | S | NE | E | SE | SE | 0 | SE | S | S |
| W | W | W | SW | W | W | SW | SW | NW | 0 | SW | S | W | SW | SW | S |
| N | NE | 0 | SE | NW | 0 | SW | S | NE | E | E | E | NE | E | SE | SE |
| NW | NW | W | SW | W | W | W | SW | N | NE | 0 | SE | NW | 0 | SW | S |
| N | N | NW | 0 | NW | NW | W | SW | N | NE | NE | E | N | NE | 0 | SE |
| NW | NW | W | W | NW | W | W | W | N | N | NW | 0 | NW | NW | W | SW |
| N | N | N | NE | N | N | NW | 0 | NE | NE | NE | E | N | NE | NE | E |
| NW | N | NW | NW | NW | NW | W | W | N | N | N | NE | N | N | NW | 0 |